



Swimming pool treatment with UV

UV is an effective way to eliminate contaminants commonly found in pools.

By David R. Smith

Without proper disinfection, swimming pools, wading pools, water parks and water rides can all cause the following symptoms on bathers:

- burning eyes;
- itchy skin;
- swimmer's ear; and
- upset stomach.

In the past, the disinfection of choice for pool applications has been chlorine. However, with the use of chlorine, disinfection by-products (DBPs), such as chloramines and trihalomethanes (THMs), lead to the above discomforts for bathers.

To reduce the level of DBPs ultraviolet (UV) light systems are now being used as a supplemental disinfection method to chlorination.

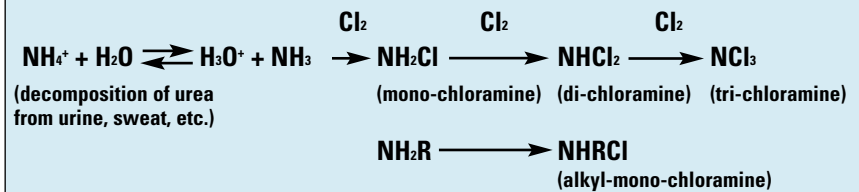
Concerns and effects of chlorine and chloramines

Chlorine disinfection requires additional chemicals and periodic testing to maintain the proper pH balance. But, the addition of chlorine to water lowers the pH of the water.

Chlorine works best within a range of 7.2 to 7.8. Outside this range, the pool bather begins to show skin and/or eye irritation.

As the pH drops with additional chlo-

Good chlorine, bad chlorine



Chlorine is a strong oxidant that provides disinfection against bacteria commonly found in pools such as:

- *E. Coli*,
- *Shigella* — gastroenteritis;
- *Pseudomonas Aeruginosa* — skin ear and eye irritations; and
- *Legionella* — respiratory.

State and federal regulations require a free chlorine, or good chlorine, residual between 1 and 3 parts per million (ppm). The free chlorine is the amount of chlorine that can combine with the organic materials found in pools.

The organics reacting with the free chlorine become the combined chlorine, or bad chlorine. The more organic materials — such as dander, skin oils and lotions — that settle in a pool, the more chlorine is needed to keep the required residual.

The more chlorine that is used, the more combined chlorine, as chloramines, are formed.

The National Spa and Pool Institute has a suggested a combined chlorine level of zero, while the industry standard attempts to maintain the level below 0.2 ppm.

— D.R.S.

rine, another chemical, such as soda ash, is added to raise the pH.

Adding more chlorine — again requiring additional chemicals to maintain the desired pH of 7.5 — creates

chloramines, which results in further eye irritation and respiratory problems for bathers and gives off the strong chlorine odor common at most indoor pool complexes.

In addition, corrosion to metal components of the pool — ladders, handrail, the building's heating, ventilation and air conditioning system (HVAC) and other unpainted metal surfaces — is directly caused by chloramines.

UV is the solution

To stop the vicious cycle of adding chemicals, UV is the best solution. UV treatment, in addition to chlorination, will lower the amount of chlorine and other chemicals, while preventing adverse effects on the pH balance of the pool.

Ultraviolet light will not only lower chemical costs, it will also reduce chloramines up to 80 percent, thus eliminating the strong chlorine odor.

Benefits of UV in swimming pools

#1 Lower contaminant levels

One advantage of using UV in a pool application is the level of disinfection it creates against viruses, bacteria, cysts and protozoa.

The disinfection is made without affecting the taste, odor or pH balance in the pool.

Data from the EPA UV Disinfection Guidance Manual (June 2003) shows a 99.99 percent disinfection of *Cryptosporidium* with a dosage of 40 mJ/cm².

A properly sized UV system will disinfect the entire volume of a pool in six hours or less with a turnover rate at a minimum of four times per day. The turnover rate of four times per day is the minimum requirement for all US states.

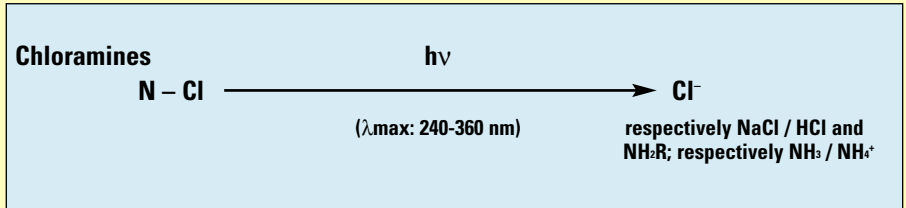
The UV system is a constant disinfection source delivering a safe chemical-free barrier against unfound fecal accidents in a fraction of the time required by chlorine.

#2 Removal of chloramines

An additional advantage of using UV light in pool applications is the reduction of chloramines.

The interaction between free chlorine and organic matter forms chloramines (see Good chlorine, bad chlorine, page 56). It is the concentration above 0.2 ppm of chloramines where the chlorine odor and bather symptoms begin.

Ultraviolet light photosynthesizes chloramines, breaking them down into salts, as seen in the following equation:



How well does UV light reduce chloramines?

Claims have been made that UV reduces chloramines up to 85 percent. Such a reduction lessens the chlorine odor and lowers the corrosion rate on the building's HVAC system, thus reducing maintenance costs.

The UV system allows for the reduction of chlorine use by over 50 percent, cutting chemical costs in half for both chlorine and soda ash for disinfection and pH adjustments.

Increasing the amount of free chlorine

may reduce the required disinfection contact time of chlorine.

The time it takes for the results of UV treatment to be seen in a pool with chlorine and chloramines is shown in Figure 1:

Whether ultraviolet light is being produced from a low-pressure/low intensity system, a medium-pressure/high intensity system or a low-pressure/high

intensity system, disinfection and reduction of chloramines will occur.

In terms of germicidal effects, the optimum UV range is between 245 and 285 nm (nanometers), which is the heart of the UV-C range (200 to 280 nm).

Different types of UV systems will comparatively have their own advantages and disadvantages.

Placement of a UV system

The placement of the UV system is shown in Figure 2 (see page 58). It is placed after the filters for disinfection of

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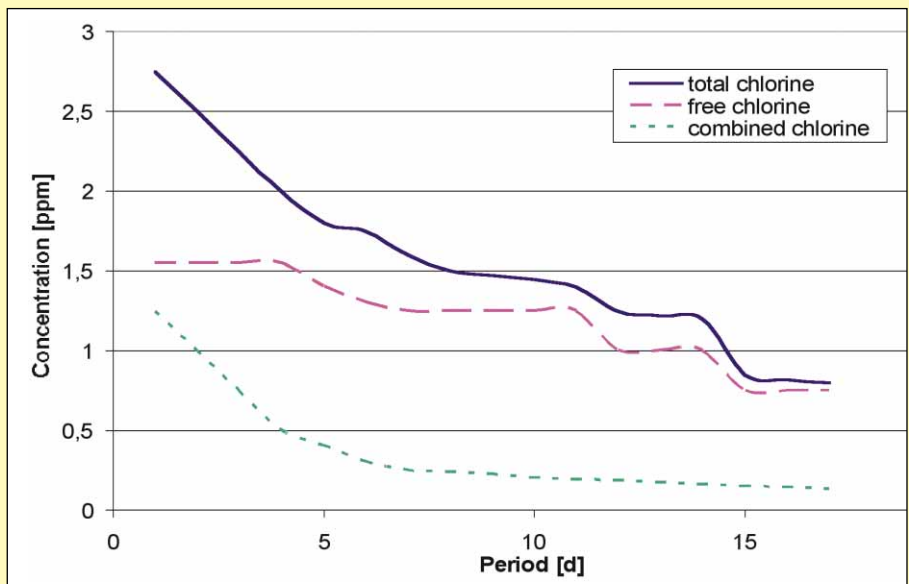


Figure 1

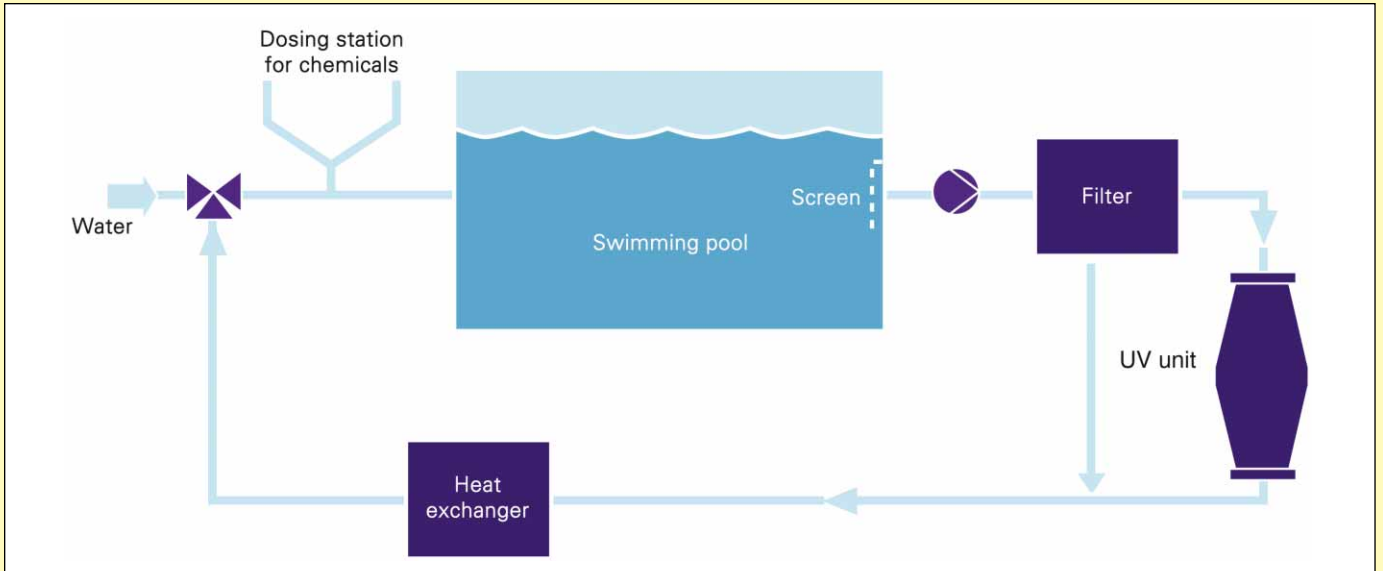


Figure 2

(Continued from prior page)

the filtered water and before the chlorine addition to prevent, if any, chlorine

destruction.

Sizing a UV system

When sizing an ultraviolet light sys-

tem start by looking at the following characteristics:

- Volume of the pool;
- Turnovers per day;

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Structure of chloramines

Chloramines occur in three different forms: mono, di and tri-chloramine phases. The majority of chloramines are mono-chloramines, which are oxidized at 245 nanometers (nm) wavelength.

Since di- and tri-chloramines are naturally unstable, they will decay to mono-chloramine as the mono-chloramine levels are reduced. Thus, all three types of chloramines are lowered.

— *D.R.S.*

- Type of pool; and
- Required chlorine residual.

The bather load and chloramine levels are other factors to be considered when sizing the UV system. These fac-

tors are handled differently depending on the type of UV system being used for the application.

A common dosage range for UV light is 30 mJ/cm² to 80 mJ/cm². The low number is used in private pools and other low bather load pools, while the higher dosage systems are used in spas, hot tubs and kiddie pools.

References

1. Gilkey, David P. DC, Williams, Holly A. DC, Water Disinfection By-Products: Trihalomethanes and Carcinogenicity – Should DCs Care?, www.chiroweb.com/hg, February 1, 2004.
2. Water Chemistry for Swimming Pools, North Carolina Division of Environmental Health, Department of Environment and Natural Resources,

www.deh.enr.state.nc.us/ehs/quality/wph.htm

3. Surveillance for Waterborne Disease Outbreaks — United States, 1991-1992, CDC MMWR Surveillance Summaries, 11/19/1993 / 42(SS-05);1-22
4. Pool Treatment 101, Chlorine Chemistry Council, www.c3.org/chlorine_knowledge_center/PoolTreatment101.html
5. UV Disinfection Guidance Manual Proposal Draft, June 2003, US Environmental Protection Agency (EPA). □

David R. Smith, applications sales engineer for Wedeco UV Technologies, Inc., Charlotte, NC, has worked in the water industry for over 15 years. His knowledge of the water industry covers UV, filtration, membrane technology and water chemistry.

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